REMARKS

I. Preliminary Remarks

Claims 32-59 are pending. Claims 32, 39, 43, 48-51 and 57-59 are amended herein. Applicants request reconsideration of the claim rejections based on the foregoing amendments, and on the following remarks.

In the Office Action, claims 32-59 stand rejected based in whole or in part on U.S. Patent 6,113,769 ("Uzoh") or U.S. Patent 5,352,350 ("Andricacos"). Both of these references are concerned with maintaining chemical concentration in an electroplating cell. However, the teachings of these references are easily distinguished from the present invention in many ways.

For one, the objectives of Uzoh and Andricacos differ significantly from the objective of the present invention as expressed in claims 32-59. Both Uzoh and Andricacos teach creating a homogeneous solution to ensure uniform plating quality in a static electroplating bath. However, the present invention is not concerned with electroplating. The present invention is concerned with creating high-quality, crystalline particles having low superficial density and high surface area suitable for use in a metal/air fuel cell. These characteristics optimize power production in the fuel cell, and allow the particles to travel through the fuel cell while entrained in an electrolyte flow.

In order to achieve the desired high-quality metal particle, the present invention circulates electrolyte solution at a turbulent flow velocity through an electrolyzer. Concentration of the electrolyte solution flowing through the electrolyzer is controlled using a method based on two circulation loops. Initially, a first circulation loop is established by circulating solution through an electrolyzer, into a container, out of the container, and back into the electrolyzer.

In the first circulation loop, electrolysis causes metal particles to form on a cathode, and thus the ionic concentration of the solution diminishes over time. To maintain the electrolyte concentration within a prescribed range as it approaches a low limit, a second circulation loop is established by diverting a portion of the flow out of the container into another container that contains a higher concentration of electrolyte solution. In the second circulation loop, a portion of the higher-concentration solution is drawn out and circulated back into the electrolyzer, thereby raising the concentration of solution being electrolyzed. As ionic concentration

approaches a high set point, the second circulation loop is closed, and the first circulation loop is reëstablished. In this way, the concentration remains within the prescribed range as solution is exchanged between a first container which holds a high concentration of the solution, and a second container which receives outflow from the electrolyzer, all while maintaining a turbulent flow sufficient to ensure high-quality particle production.

In the specification, the first circulation loop corresponds to "closed-container mode", in which the second container is isolated from the first container. The second circulation loop corresponds to "open-container mode", in which electrolyte solution is exchanged between the first and second containers. *See* Application, pp.33-34; FIGS. 22-23.

An important distinguishing characteristic of the present invention reflective of its differing objective is that the present invention can tolerate a wide range of electrolyte concentrations (*e.g.* between about 0.5M and 4.0M) when producing metal particles. This characteristic is not taught or suggested in Uzoh or Andricacos, both of which seek to maintain constant chemical concentration.

Furthermore, both Uzoh and Andricacos use a pre-mixing stage for creating a homogeneous solution prior to pumping the solution to an electroplating cell. The present invention, however, does not require a pre-mixing stage. Unlike Uzoh and Andricacos, the present invention continuously mixes solution through the circulation loops, without having to close off a circulation loop during pre-mixing.

Furthermore, both Uzoh and Andricacos teach a plating bath for an electrolytic plating process. The present invention teaches circulating electrolyte solution at high, turbulent flow velocity through an electrolyzer configured for growing a plurality of metal particles.

With the foregoing distinctions and claim amendments in mind, the claim rejections are now refuted, as follows:

II. Response to Objection Under 37 CFR 1.75(d)(1)

Claim 51 is amended herein in response to the objection under 37 CFR 1.75(d)(1) to recite an "outlet valve" according to the Examiner's recommendation.

III. Response to §102 Rejections

In part 4 of the Office Action, Claims 32, 39, 48-49 and 54-55 stand rejected under 35 USC §102(b) as being anticipated by Uzoh. In part 5 of the Office Action, Claims 32, 39, 48-49 and 55 stand rejected under §102(b) as being anticipated by Andricacos.

It is well settled in the law that in order for a prior art reference to anticipate in terms of 35 U.S.C. §102, every element of the claimed invention must be identically shown in a single reference. *Diversitech Corp. v. Century Steps, Inc.*, 850 F.2d 675, 677, 7 U.S.P.Q.2d 1315, 1317 (Fed. Cir. 1988). For a proper rejection of a claim under 35 U.S.C. §102(b), the cited reference must disclose all elements/features/steps of the claim. See, *e.g., E.I. du Pont de Nemours & Co. v. Phillips Petroleum Co.*, 849 F.29 1430, 7 USPQ2d 1129 (Fed. Cir. 1988). "Anticipation requires the disclosure in a single prior art reference of *each element* of the claim under consideration." *W.L. Gore & Associates. Inc. v. Garlock. Inc.*, 721 F.2d 1540, 1554, 220 U.S.P.Q. 303,313 (Fed. Cir. 1983)(emphasis added). Therefore, every element recited in a claim must be represented in the applied reference in order for that reference to constitute a proper rejection under 35 U.S.C. §102.

a. Uzoh fails to teach turbulent flow in first and second circulation loops

Turning first to amended Claim 32, the §102 rejection of claim 32 based on Uzoh cannot be sustained because Uzoh fails to teach or suggest the following limitations:

> *circulating the second body at a turbulent flow velocity through an electrolyzer in a first circulation loop;* [and]
>
> *circulating a portion of the first body and a portion of the second body at a turbulent flow velocity through the electrolyzer in a second circulation loop.*

First, keep in mind that Uzoh doesn't teach *circulating* solution through an electrolyzer as essential to achieving high-quality electrodeposition. Uzoh teaches maintaining a plating bath or reservoir, and nowhere suggests that a turbulent flow velocity be maintained for the solution during electrolysis in the bath. *See, e.g.* Uzoh, col.3, ln. 30 to col.4, ln. 26. Uzoh teaches mixing chemicals in a premix tank 17 rather than mixing chemicals in the plating bath reservoir. Uzoh, col.4, ln.9-17. Thus, flow conditions within Uzoh's plating bath are nearly static conditions, far

from turbulent.

However, in the independent claims (32, 39 and 59) as amended herein, when the second container is isolated from the first container, electrolyte solution is circulated at a turbulent flow velocity in a first circulation loop through the second container (and not the first container). Then, responsive to sensing low concentration, the solution may be circulated at a turbulent flow velocity in a second circulation loop through both first and second containers. *See* Application, p.19, ln.11 to p.22, ln.12; p.33, ln.3 to p.35, ln.4; and FIGS. 13, 22-23.

As noted above, the method of the present invention exploits the fact that high-quality metal *particle* production may be achieved over a much wider range of electrolyte solution concentration than Uzoh allows for when electroplating substrates. *See* FIG. 13, which indicates that ZnO molarity in the range of 0.5 M to 4.0 M can produce high quality particles. The present invention advantageously provides first and second circulation paths as a means for maintaining the concentration within such a range. And, due to the high-velocity turbulent flow required to achieve high-quality particle deposition (Application, p.19-22), the present invention advantageously eliminates the need for Uzoh's premix tank by continuously mixing high and low concentration solution within the circulation paths themselves.

Since Uzoh fails to teach or suggest circulating the second body at a turbulent flow velocity through an electrolyzer in a first circulation loop, and fails to teach or suggest circulating a portion of the first body and a portion of the second body at a turbulent flow velocity through the electrolyzer in a second circulation loop, Uzoh cannot form the basis for a rejection under §102. Therefore, Applicant requests that the rejections of Claims 32 and 39 based on Uzoh be withdrawn, along with the rejections of all related dependent claims.

b. Andricacos fails to teach first and second circulation loops

Andricacos fails to anticipate Claim 32, as amended, because Andricacos fails to teach at least one of the following limitations:

> *circulating the second body at a turbulent flow velocity through an electrolyzer in a first circulation loop;* [and]
>
> *circulating a portion of the first body and a portion of the second body at a turbulent flow velocity through the electrolyzer in a second circulation loop.*

With reference to FIG. 2 of Andricacos, Andricacos clearly does not contemplate first and second circulation loops through an electrolyzer. Andricacos teaches a single circulation loop through a plating cell, as shown by the MIX TANK, recirc pump, and PLATING CELL. In addition, Andricacos clearly does not teach or suggest causing turbulent flow velocity when circulating solution through first and second circulation loops.

Claims 39 and 59 contain similar distinguishing limitations over Andricacos. For the same reasons discussed above regarding Uzoh, Applicant's method reciting turbulent flow through first and second circulation loops distinguishes the present invention over the cited art. Applicant therefore requests that the §102 rejections of Claims 32 and 39, and the rejections of all related dependent claims, be withdrawn.

IV. Response to §103 Rejections

a. Obviousness rejections based on Uzoh are moot

In part 7 of the Office Action, Claims 33-38, 40-47, 50-51 and 57-58 stand rejected as obvious over Uzoh. The Office Action asserts that limitations expressed in each of these dependent claims would be obvious, without citing additional references. Applicant holds that each of these rejections are moot in view of the foregoing refutation of Uzoh-based §102 rejections of the independent claims from which Claims 33-38, 40-47, 50-51 and 57-58 all depend. Accordingly, Applicant requests withdrawal of the rejections under §103.

b. Obviousness rejection of Claims 36 and 43 based on Uzoh is improper for lack of suggestion and for hindsight reconstruction

In part 7 of the Office Action, in rejecting claims 36 and 43, the Office Action asserts that it would have been obvious, based on the teachings of Uzoh, to maintain temperature in the second body (plating reservoir) by feeding solution from the first body (CHEM A tank) into the second body. That assertion lacks credibility, because by feeding solution in such a manner, the chemical concentration in Uzoh's second body would be thrown off-scale by introducing a volume of concentrated chemical solution from CHEM tank A, solely for the purpose of temperature control and without regard to maintaining electrolyte concentration consistent with Uzoh's stated objectives. *See* Uzoh, col.1, ln. 55-64.

Uzoh's primary objectives, and indeed, his entire disclosure, is devoted to maintaining chemical concentration in the plating reservoir as uniform as possible to ensure consistent quality when plating material onto a substrate. Nowhere does Uzoh teach or suggest the limitation of Claim 36, whereby solution is exchanged between first and second containers responsive to sensed temperature in order to maintain temperature in the second container within a predetermined range. Uzoh's system is not capable of controlling temperature in such a manner while maintaining a desired range of concentration within the plating bath. Accordingly, Uzoh teaches away from controlling temperature in the manner recited in Claims 36 and 43, and therefore cannot form the basis for an obviousness rejection as a matter of law.

On the other hand, because the present invention is directed to metal *particle production*, as opposed to metal plating, the present invention can tolerate a much wider range of electrolyte concentration, as previously explained. This enables Applicant's method for controlling temperature by exchanging solution between the first and second containers, without exceeding the concentration limits that are also under control.

Furthermore, because there is no suggestion or motivation in Uzoh to control temperature in the manner claimed, it is only through hindsight that the claimed method of temperature control may be imputed to Uzoh. Thus, the rejection of Claims 36 and 43 are contrary to well-settled Federal Circuit law holding that it is improper to advance an obviousness rejection by using the teachings of the invention under examination as a guideline for hindsight reconstruction of the claims. *See W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 220 USPQ 303, 312-13 (Fed. Cir. 1983), *cert. denied*, 469 U.S. 851 (1984). Accordingly, Applicant respectfully submits that the obviousness rejection of claim 36 should be withdrawn.

c. Obviousness rejection of Claim 50 based on Uzoh is improper because Uzoh does not contemplate first and second valve inlets from first and second circulation loops

In part 7 of the Office Action, Claim 50 is rejected as obvious over Uzoh. Claim 50, as now amended, recited the following limitation:

> *circulating the solution to the pump through a tempering valve having first and second valve inlets, the first valve inlet in fluid communication with the first container and the second valve inlet in fluid communication with the second container*

In rejecting Claim 50, the Office Action asserts that it would have been obvious, based on Uzoh, to use a three-way tempering valve to mix first and second bodies of solution at an inlet to pump 53, whereby the valve would (i) continuously recirculate the second body, and (ii) control the rate of addition of the second body to the first body.

Here again the Office Action engages in impermissible hindsight reconstruction. There is no application for a three-way tempering valve in Uzoh because his first body of solution (CHEM A) is completely isolated from pump 53. Because CHEM A is isolated from pump 53, there is no teaching or suggestion in Uzoh to control the rate of addition of the second body (plating reservoir) to the first body (CHEM A) using pump 53. *See* Uzoh, FIG. 1. In the absence of this suggestion, the Office Action creates an imaginary conduit between the CHEM A tank and pump 53. This is another case of impermissible hindsight reconstruction, and the rejection cannot be sustained as a matter of law.

Note that the present invention provides first and second circulation loops, each of which may commonly circulate through respective inlets to tempering valve 2228 and thence to pump 2208. Application, FIG. 22. Thus, the present invention may employ a three-way tempering valve at the pump inlet, as recited in Claim 50, whereas Uzoh cannot.

d. Obviousness rejections based on Uzoh in view of Siu are moot

In part 8 of the Office Action, Claims 52-54 and 56 stand rejected as obvious over Uzoh in view of U.S. Patent 5,958,210 ("Siu"). Applicant holds that each of these rejections are moot in view of the foregoing refutation of Uzoh-based §102 rejections of the independent claims from which Claims 52-54 and 56 all depend. Applicant notes that Siu does not provide the circulation loop and turbulent flow teachings found lacking in Uzoh and recited as limitations in each of Claims 52-54 and 56. Accordingly, Applicant requests withdrawal of the rejections under §103.

c. Obviousness rejections based on Uzoh in view of Talasek are moot

In part 8 of the Office Action, Claims 51 and 59 stand rejected as obvious over Uzoh in view of U.S. Patent Application Publication No. 2004/0108213 ("Talasek"). Applicant holds that each of these rejections are moot in view of the foregoing refutation of Uzoh-based §102 rejections of the independent claims from which Claims 51 and 59 depend. Applicant notes that Talasek does not provide the circulation loop and turbulent flow teachings found lacking in Uzoh

and recited as limitations in each of Claims 51 and 59. Accordingly, Applicant requests withdrawal of the rejections under §103.

V. Conclusion

In view of all of the above, Applicant submits that all claims remaining in the Application are patentable over Uzoh, Andricacos, Siu, Talasek, and any combination thereof.

Applicant believes no fees are due in connection with this Response. However, if any such fees are in fact due, the Commission is authorized to charge the same to our deposit account no. **19-2814**, referencing Snell & Wilmer Dkt. No. **50534-0300**.

Respectfully submitted,

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